

# Effective Electronic Performance System Training for Supporting the Clinical Activities of Physicians

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## ABSTRACT

This study investigated the potential effectiveness of the Electronic Performance Support System (EPSS) in supporting the clinical activities of physicians. A research questionnaire was used to tap information about the perceptions of physicians at selected hospitals on the effectiveness of EPSS as an essential technology for clinical activities. The physicians perceived the concepts of EPSS as very important, both for clinical activities and for the improvement of individual physicians and the entire organizational performance. This paper reports on the components and functions of the major types of EPSS, and the impacts of technological changes in the medical settings. The characteristics and benefits of the EPSS in the clinical workplace are discussed. Change management phases in the medical settings to help physicians overcome the barriers of resistance associated with introducing new technology are presented.

**Keywords:** Electronic performance support system, medical technology training.

## 1. INTRODUCTION

The emerging technologies have profoundly altered our world. Technology has made its impact in the healthcare settings by enhancing how physicians treat patients, identify diseases and infections, monitor critical conditions in patients, perform routine and infrequent tasks such as changing heart valves and installing blood pumping devices, and use new methods to perform surgical operations. Innovative technologies are improving the quality of healthcare “as more workers come to depend on the use of computers to do their jobs” [1]. The rapid transformation in medical technologies is making the hospital environment, the tasks, the workflows, the physicians, and workforce to incessantly change [14], in response to the rising costs due to medical progress such as “new drugs, new tests, new technologies, and new ways of using these technologies” [10], and to efforts towards continuous improvement by the workforce [14]. Without a doubt, “technology has become a powerful force in the world forming the totality that is difficult to understand as a whole” [11].

As the technological development continues to intensify, the healthcare is becoming increasingly complex due to new procedures, complex care, powerful drugs, and more prolonged hospitalizations. In the midst of these complexities in healthcare environments and “as hardware and software technologies

continue to advance” [1], the expansion of efficient, useful, and practical clinical information has become a significant focus. The workplace also demands that physicians “be very agile in the use of information, tools, energy and materials, and to continuously engage in learning” [11]. The major activities of the physicians therefore require constant adaptation because of new information, frequent changes, and new job requirements. Lee explains that “what doctors know and do is constantly changing but the needs of the patients remain the same” [10]. Therefore, physicians require continuous learning to provide quality health services.

Chang comments that “traditional training lacks effective transfer of knowledge and skills and performance support” [3]. What happens when physicians are unfamiliar with computer applications? Ladd inquires if they should “ask someone for advice, look up information, take a workshop, or call someone on the phone?” [8]. Ladd further argues that “those tactics might be quick but the work gets interrupted and the worker becomes unproductive during the time we need his or her help” [8]. It seems clear that the traditional training cannot sufficiently prepare physicians for today’s complex workplace. The need exists to reduce the required learning time to achieve a successful performance, and to increase productivity [7].

It is necessary to use smart technologies to support the current jobs of physicians, to help them perform better, learn better, treat patients with satisfaction, and to propel the healthcare organizations to successful progress. This could be achieved by making use of educational awareness of the EPSS to overcome the breakdown social barriers associated with physicians’ egos [14]. With such systems, physicians can easily access information, seek help or reference, and get training to upgrade their knowledge when and where they need it [4]. Gery points out that an “electronic performance support system is employed to support skills and knowledge development in real time and at the workstation” [5]. Herein is a typical scenario of the use of an EPSS:

*Bill receives a doctors’ order to begin an intravenous line on a patient, Bill discovers that, to his dismay, that the equipment used to pump medication into a patient’s veins has been changed, a new and improved system has been adopted. What can Bill do at 1:30 am? With no one around to ask, Bill turns to EPSS and clicks on the reference icon, selects the equipment menu item, selects the I.V therapy and clicks on the name of the infusion and pump system from a popup menu. Bill reviews the diagram of the equipment and the procedures for setting up and medication dosing; infusion is begun and patient’s medication is delivered accurately, the first time around [13].*

This research study investigated the potential effectiveness of the EPSS to support the clinical activities of physicians at hospitals in rural areas. The research questions investigated included:

- What are the performance problems encountered in rural hospital settings such as the Immaculate Heart Hospital (IHH) in Nigeria?
- Which specific component of the EPSS will meet the needs of rural hospital physicians in decision support and the improvement of diagnosis?
- What are the benefits of using an EPSS in rural hospitals?

## 2. PURPOSE

IHH was established in the 1980s to promote diagnosis and medical treatment to Nkpor natives and the surrounding communities in Nigeria. It has 10 physicians, and most of them received medical training five to eighteen years ago. The physicians received trainings that are no longer aligned with the demands of the hospital workflow. In 2000, the hospital introduced electronic equipment such as ultrasounds, x-ray, and computers in the offices of physicians, for use in providing efficient services to the patients. The new technologies are frequently very complex and require trained personnel. The physicians are becoming overwhelmed with so much work because they do not have the skills to perform efficiently with these new technologies. They no longer have enough time to focus on quality care for patients. They lost control of their expertise which instigated series of medical errors in their daily work. IHH physicians therefore need critical information for their routine diagnosis and there is no available expert to help solve the technology problems.

Lee and Liu state that “as the rate of change accelerates, even experts may have to struggle to maintain their level of performance” [9]. To cope with change ten physicians from Immaculate Heart hospital frequently go overseas for professional training. This entails taking leaves of absence for two to three months to complete professional development courses, and the organization spends large sums of money on travels and training. This creates inefficiency and performance problems because the organization has limited funds and time for continually training the entire physicians. Physicians in rural areas need training to use new technologies and to continually upgrade proficiencies.

Physicians in rural areas face problems from the continuous evolution of new technologies, the rising cost in medical settings, the lack of critical information, inappropriate tools, lack of skills, series of errors, and new job activities. At Immaculate Heart Hospital, physicians need technological tools in a support system to enhance performance and provide them with “information access, decision analysis, problem solving, job advice, online reference, and learning support” [3]. This support system might be designed to include the following features: expert system, online help or reference system, interactive training system, and customized tools. Today, there is limited research on the exact descriptions of the design and implementation of EPSS in medical settings. The EPSS in medical settings is still in infant stage and far behind the research activities in businesses and education.

## 3. DEFINITIONS

The terms used in this study are:

**Electronic Performance Support System (EPSS)** –a powerful tool for coaching, training, job aids, or reference material that focused on peoples’ performance rather than on the machines. It integrates software tools, knowledge, and learning experiences to improve the performance of employees.

**Change** –a transition to a new practice or a new way of doing something. Change “requires new technology, new roles and responsibilities, new skills, and a different development processes” [5]. It is the “adoption of new idea or a behavior by the company” [12].

**Decision support system** –a computer-based program that makes knowledge more interactive and real. It helps users in problem solving by providing them with various suggestions, recommendations or additional questions depending the answers provided by the user.

**Tools** –Interactive systems, hypertext platforms, case based reasoning system, or coaching facility that guide a user though performing procedures and making decisions (help system, documentations, text retrieval system, intelligent system, tutoring facility, simulation tools, and other communication services [9].

**Training** –an instructional method that provides the opportunity to cover a wide range of material within a short period of time using a variety of training techniques. Workers learn by doing rather than trying to remember the information delivered in a separate training event, away from the job environment [2].

**Computer-Based Training (CBT)** –a technique used for delivering training course using a computer. It is an approach to training that delivers traditional, modular training in a performance system rather than in a live classroom. CBT includes lessons, practice, simulations, testing learners, and training management [9].

**Reference** –functions as a librarian to provide reference information and knowledge to meet the needs of the physicians. It also serves as a basic reference resource by which physicians can do self-situated research. A reference “can include explanations, demonstrations, advice” [6].

**Expert System** –a technology that organizes and applies the knowledge of human expert to specific problems. Expert System contains a series of questions about a particular problem, and advice about how to solve the problem. It works by storing the knowledge of the human expert and the problem logic of the expert [16].

**Interface** –a window through which the user and technology communicate. It is a contact surface that directs the nature of interaction between the systems and the user. Interface consists of input interface and screen interface [9].

**Hypermedia** –a non-linear access to information stored in a computer. Carr explains hypermedia as “a way of accessing not only text but also graphics, video, and audio information” [4]. It is a combination of multimedia and hypertext.

**Hypertext** –a non-sequential access to text based information. It is a technique for organizing text so that the user can navigate

using various different ways. It is a popular tool which every online help system makes use of in some form [4].

## 4. RESEARCH METHODOLOGY

### 4.1 Population and Sample

The population consists of all physicians in the three different hospitals owned by Immaculate Heart organization: the IHHS at Nkpor and Urualla and the Mother of Christ Hospital at Enugu in Nigeria.

A sample of thirty (30) physicians was selected from the population. Out of the selected sample for a survey, 15 were women physicians and 15 were male physicians. Five female and five male physicians were selected from each of the three hospitals identified in this study. All physicians selected had been in practice for 5 to 20 years and are all involved in both outpatient and inpatient care. They all have Medical Doctorate Degrees (MDs) but there is a knowledge gap between the modern physicians and traditional physicians.

### 4.2 Survey Instrument

A structured questionnaire was designed to capture the understanding and the reaction of physicians to the introduction of EPSS at Immaculate Heart Hospital, Nkpor in Nigeria. The questionnaire used forced choice questions and included the demographics section to assist in delineating patterns of responses across tabulated analysis. The likert-scale was employed in the survey questionnaire to provide opportunity for the respondents to specify their levels of agreement with selected survey questions. The survey questions contained the background information on the topic of an EPSS. The questionnaire was used to tap information from the physicians about their gender, age, interest in technology training, the number of years in service as a physician, easy access to information of patients, access to quality care data, hours per week involved in patients' care, views on sharing quality of care data, use of medical record system, measures of performance support of the key components of EPSS, and identification of the EPSS benefits to physicians and the entire organization.

### 4.3 Data Analysis

The data collected were summarized into various tables to show the similarities among the responses of physicians from the different hospitals. The analysis looked into the similarities between the responses of the male and female physicians for further investigations of similarities using cross break analysis to identify levels of agreements by the physicians on the components and benefits of the EPSS. The computation of frequencies and percentages were used to investigate the reception of the EPSS at IHHS. Charts were used to display the percentages of the respondents that perceived the needs for the EPSS.

## 5. RESULTS AND INTERPRETATION

A total of 30 responses were returned complete –the overall response rate is one hundred percent. In order to present a meaningful interpretation of the data, the results are tabulated and contain percentages.

### 5.1 Demographic Results

Fifty percent of the total physician respondents from the three selected hospitals were males and 50% were females. The largest percentage (47%) of respondents is from 30 to 40 years range. There were no outstanding differences in age between the male physicians and the female physicians. One hundred percent of the physicians earned medical doctorates. The respondents have several other medical titles. The majority of the physicians had additional degrees such as master's degrees and also held the state certification in their different specialties. Eleven (37%) of the physicians who participated in the survey had master's degrees in another area of specialization. Although academic qualification is not related to using electronic performance support system, but it would be beneficial to enable the user to understand the skills required to perform effectively. The largest percentage of years in practice by the physicians was in the 1-5 years range. Perhaps this group of physicians is more informed about the EPSS.

Five (17%) of the respondents are specialized in obstetrics and gynecology, 17% are surgeons, 20% are pediatricians, 10% are specialized in general medicine, 23% are general practitioners, 3% are anesthesiologists, and 10% are pathologists and neurologists. All neurologists are male physicians.

### 5.2 Performance Problems

The physicians were asked if they had taken any computer training courses to help improve medical care they provide to patients. Among the physicians that responded yes to this question, 40% were males and 20% were females. These physicians have received training in word processing, keyboarding, and Internet browsing. Physicians who receive training workshops will easily adopt the new technology because of their experiences with the effectiveness of using technology to enhance the patient cares. Physicians without any computer training might find it difficult to adopt the new technology for improving job performance.

Physicians were asked if they find it easy to retrieve patients' records using the current medical systems in the hospital. As shown in Figure 1, 30% of the respondents affirmed that they can only identify their patients by type of sickness because of the required constant follow-up. The result also shows that only 10% of the respondents found it easy to access and retrieve patients' record by age, and 20% of the physicians easily access patients' records by either lab results or current medication or past medical history. Overall, more than two-thirds of the respondents reported that it is very difficult to identify patients by any of the criteria because most of the physicians manually go through the records of voluminous paper documents.

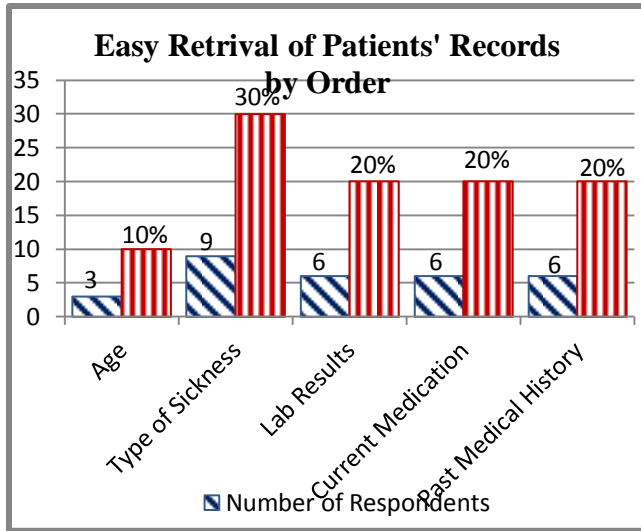


Figure 1. Easy Retrieval of Patients' Records by Order

The physicians were asked if they encounter problems while accessing high quality and accurate information needed for the care they provide to patients with certain illnesses and diagnoses. Eighteen (60%) of the physicians had no access to any accurate and quality information of patients with terminal illness. Fourteen (47%) of the physicians surveyed cannot obtain any information for HIV patients, 7% found it difficult to obtain accurate information for patients with acute malaria, while 10% reported that they carry out diagnostic hypothesis within seconds of meeting a patient who needs surgery. The physicians made decisions based their perceptions and the circumstances surrounding medical problems. Thus, there is a problem accessing quality, accurate information for patients' quality care. Most of the respondents indicated that they occasionally obtain information from medical journals, books, and experienced colleagues.

Physicians were asked how often they use electronic medical records (EMRs) in the hospital. Figure 2 indicates that only 3% of physicians use electronic medical records routinely, 33% use electronic medical records occasionally, while 64% do not use them at all. Physicians who use electronic records routinely or occasionally are more likely to generate information required for health cares than those who do not. The large percentage of physicians who do not use EMRs is problematic because the electronic medical record can generate complete records of patients and the supporting activities such as decision support, quality management and clinical reports of diagnosis.

When the physicians were asked whether they had shared or accessed quality data with their colleagues in the medical fields for providing health cares to patients, 0% responded "frequently", 43% reported occasionally, and 57% reported not at all. Physicians who had travelled overseas for professional training reported they received data from professional friends occasionally. The most common type of data they had received or shared with colleagues were medical journals or articles, books, and sometimes they consulted with experienced doctors on phone to seek advice on how to solve certain problems and issues on medications.

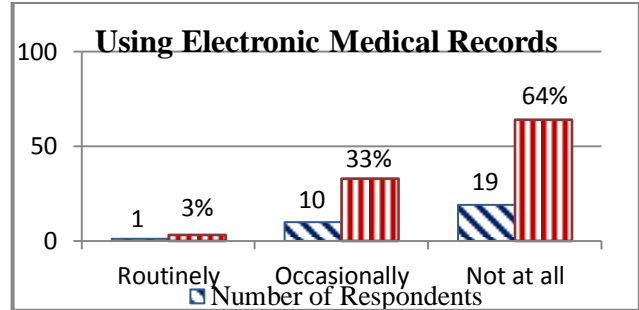


Figure 2. Using Electronic Medical Records

### 5.3 Required EPSS Components

The physicians were asked to identify the components of EPSS that would enhance their performance in the hospital. Figure 3 indicates that 37% of respondents perceived "Online Help/Reference" as the most effective component for enhancing the performance of their clinical activities at the hospital. The result shows that 23% of the respondents identified "Database" as the next component to enhance their performance. Six (20%) of all physicians surveyed selected computer-based training for upgrading their skills and knowledge at the workplace. Similarly, 17% of all respondents surveyed perceived "Expert System" as an effective component of EPSS. "Word Processing" was perceived as the least of the relevant components of the EPSS.

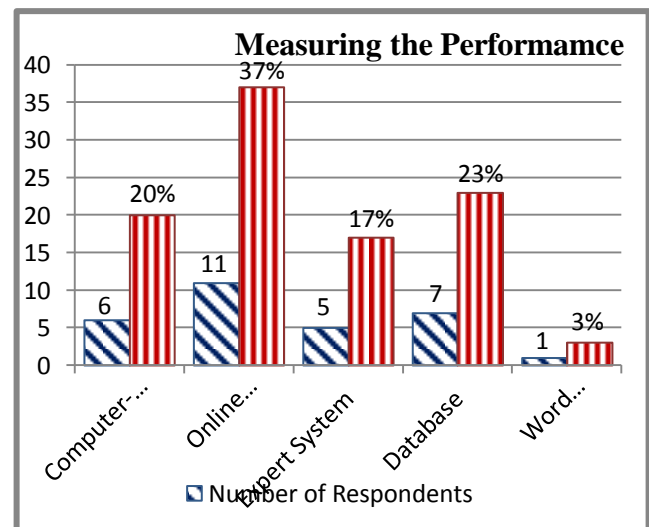


Figure 3. Measuring the Performance of the Perceived EPSS Components

The physicians were asked whether they agree or disagree on the statements listed in Figure 4. Twenty-nine (97%) of all respondents agreed that traveling overseas for development courses is very expensive while 3% felt it is not expensive. Twenty-eight (93%) of all respondents agreed that errors will decrease by using a computer system while 7% disagreed. On the other hand, 60% of all respondents believed that medical decision are difficult without technology while the remaining 40%

disagreed. The result also shows that 76% of all physicians agreed that they have massive records to sort due to the use of manual labor while 23% indicated that there are no massive records to sort. Another 76% agreed with the statement “Physicians lack proficient skills for emerging technologies for diagnosis” but 23% felt they have proficient skills to use the new technologies for diagnosis. Overall, 80% of all respondents agreed with all statements and believed that an EPSS will improve performance.

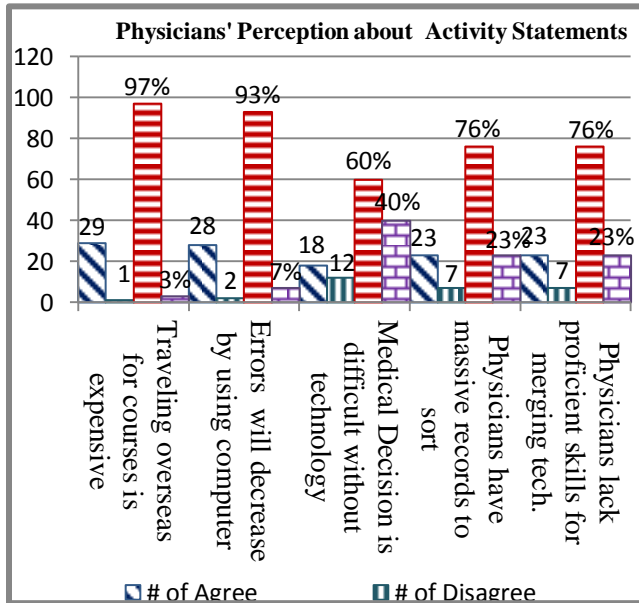


Figure 4. Physicians' Perception about Activity

### 5.4 Benefits of Using an EPSS

The physicians were surveyed about the expected benefits of using an EPSS at Immaculate Hospital for clinical activities. The results in Figure 5 indicate that 100% of the respondents specified that an EPSS will improve the quality of information for diagnosis. Twenty-nine (97%) of the physicians, felt that an EPSS will provide a guided feedback. Similarly, another 97% of the respondents perceived an EPSS as appropriate for assisting physicians in completing clinical activities more quickly. Twenty (67%) of the physicians stated that the use of an EPSS will reduce the training time and cost of traveling to overseas for development training. The results also indicate that 97% of respondents believed that an EPSS will decrease errors in routine diagnosis and increase accuracy in clinical activities.

Physicians were surveyed about leaving the country every two years to attend professional training overseas. Twenty-nine (97%) of the respondents indicated leaving the country to attend a development course for upgrading skills. Similarly, 20% of the respondents felt that traveling overseas for professional studies will reduce training cost while the remaining 80% disagreed. On the other hand, 83% of the respondents agreed that traveling overseas for development courses does not improve retention but the remaining 17% disagreed. Thirteen (43%) of the all respondents surveyed agreed that it is time consuming to leave the country every two years to attend professional development while 57% disagreed. Overall, 80% of all respondents to the question

agreed that traveling overseas for development training assist physicians to upgrade their skills but it does not reduce the training cost, improve retention, and it is time consuming while 20% disagreed.

The physicians were asked about the EPSS assistance required to improve the performance of patients' cares and to upgrade competencies. The responses in Figure 6 indicate that 63% of the total respondents perceived that a training system would help improve job performance and patients' care and to upgrade their, while the remaining respondents had no opinion. The results suggest that only 67% identified decision support system as very important for guiding them in problem-solving. Twenty-six (87%) of the total respondents surveyed felt that an online system would assist in performing better, upgrading their competencies, and in providing explanations or references. On the other hand, 80% of the respondents believed that videos showing procedures for performing difficult tasks would be most useful for improving their performances, while 93% indicated the knowledge base with quick and easy access to quality and accurate information as the most useful system for integration into their clinical activities. Thus, the majority of the physicians surveyed perceived that the implementation of an EPSS at IHHs will improve performance, accrue benefits, reduce error, and increase access to quality information for the clinical activities catered to patients.

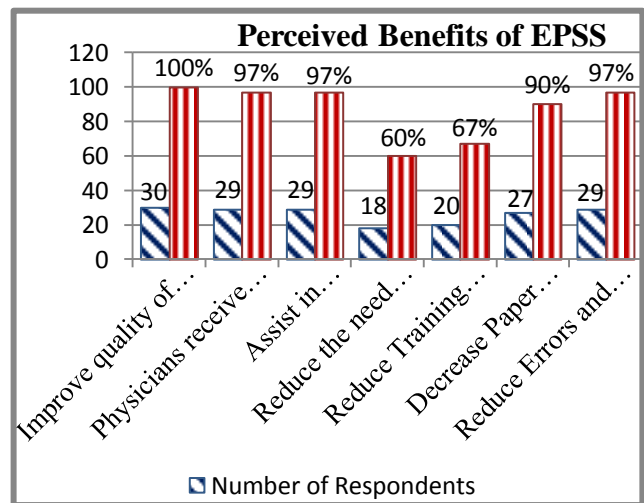
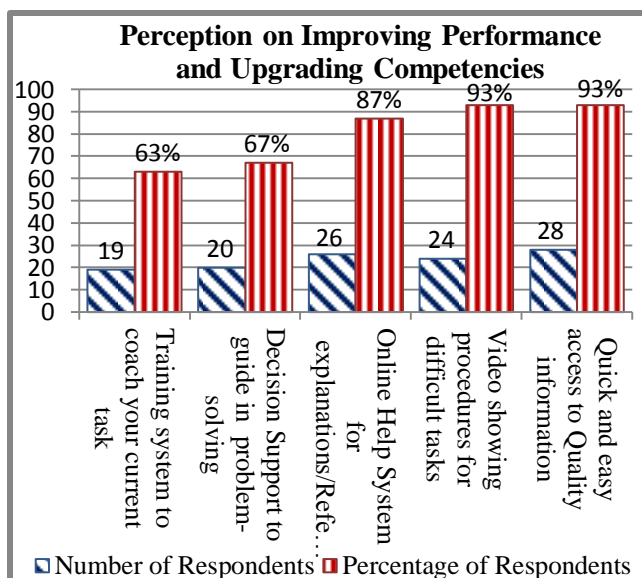


Figure 5. Perceived Benefits of EPSS

## 6. CONCLUSIONS

Based on the results of this study, there are major problems encountered by the physicians in their daily clinical activities at IHHs. These problems are identified as: lack of proficient skills for the emerging and changing technologies, lack of access to quality and accurate information for services they provide to patients, lack of in-service training for improving their job skills and knowledge, overwhelming massive paper documents to sort out that imposes a series of errors due to simple mistakes caused by entering and sorting data contained in voluminous manual paper documents. The resultant effect is decrease in the performance of physicians and quality care and services to patients.



**Figure 6. Perceptions on Improving Performance and Upgrading Competencies**

The study shows that sixty-four percent of the physicians do not use electronic records to generate information for patients' cares, even though the EMRs have the ability to generate complete records of patients as well as support other activities such as decision support, quality management and clinical reporting of diagnosis. The IHH organization spends large sums of money on travel expenses for training physicians overseas. This creates a performance problem because the organization does not have sufficient funds and time for continuously training the entire physicians. Physicians need proficient skills to use the new technologies and to always upgrade competencies.

The EPSS implementation for physicians should include components such as intelligent user interface, computer-based training, online/reference system, database system, and advisory/expert system-coaching facility that will assist physicians in routine tasks and decision-making. The database will provide physicians with quick access to previous medical cases, critical information about past diagnosis and treatments. Computer-based training can include videos that show procedures, simulations of tasks, tutorials, and scenarios. The user interface should use images such as hospital emblems to reflect a real-life situation, and should be implemented using menus, buttons, dialogue boxes and natural language to meet the diverse information needs by specific physicians [4].

The implementation of the EPSS at IHHs will derive enormous benefits. The EPSS can help physicians to organize job activities, coach them, and provide examples on job procedures. Physicians can use an EPSS to look up pertinent and quality information, continue training on the job, and request assistance from online experts any time. The use of an EPSS at IHHs will help reduce errors, training costs, and travel expenses, and increase the depth of learning. With an EPSS, physicians will always have access to up to date information and procedures for the diagnosis and treatment of patients. An EPSS will improve the performance of both physicians and the entire hospital.

The EPSS was rated by physicians as a highly appropriate technology for improving the quality of clinical activities. The EPSS was perceived to be a potential tool for assisting the physicians in quickly completing clinical activities with guided feedbacks. With an EPSS, the training time and costs, errors in routine services would decrease while the accuracy and access to quality information would increase. An EPSS will make learning faster and effective, and will deliver assistance in the context of an actual job when a physician needs it [4].

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